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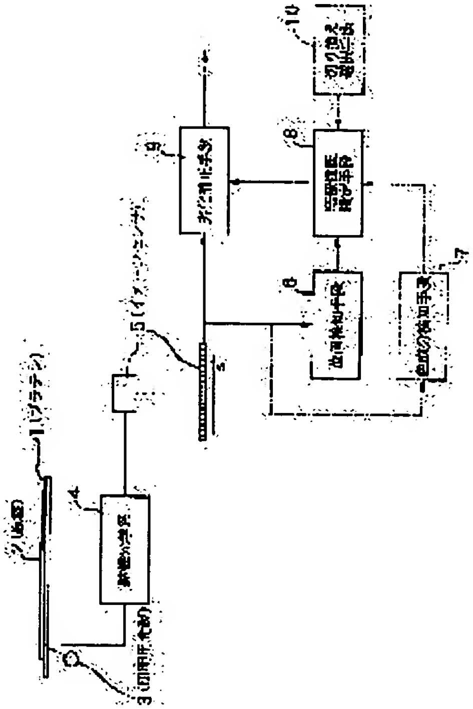
## (54) PICTURE READER



(57)Abstract:

PURPOSE: To allow the reader to properly correct picture deterioration resulting from its image optical system and to obtain picture information with high quality.

CONSTITUTION: The reader is provided with a position detection means 6 detecting a position of a picture signal read by an image sensor 5 with respect to the image sensor 5 in a scanning direction (s), an image forming performance setting means 8 setting the image forming performance information of an image forming optical system 4 at the position of the picture signal detected by the position detection means 6 and a correction means 9 correcting the deteriorated state of the picture signal in response to the image forming performance information set by the image forming performance setting means 8, and a color picture reader especially utilizes detection information from a color component detection means 7 to set the image forming performance information for each color component by the image forming performance setting means and uses the correction means 9 to correct the deteriorating state of the picture signal of each color component.

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LEGAL STATUS

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| [Date of final disposal for application] | |
| [Patent number] | |
| [Date of registration] | |
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| [Date of requesting appeal against examiner's decision of rejection] | |
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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to an image reader and relates to amelioration of the image reader of the type which carries out image formation of the manuscript image on Rhine-like image sensors through image formation optical system especially.
[0002]
[Description of the Prior Art] Conventionally, this kind of image reader carries out the sequential exposure of the manuscript side on a platen in the light source for lighting at the shape of a slit, carries out image formation of the slit-like reflected light from a manuscript side on Rhine-like image sensors in image formation optical system, and reads a manuscript image. If it is in such an image reader, the picture signal taken out from image sensors will become the image information which deteriorated on the relation in which the optical image on the above-mentioned image sensors has usually deteriorated according to image formation optical system (curvature of field). Then, if it was in the former, fixed high emphasis processing (the MTF [abbreviation for Modulation Trasfer Function] amendment processing) was performed to the whole picture signal taken out from image sensors, and it was coped with so that degradation of the above-mentioned image might be amended (for example, "digital image processing", Nagao true work, Kindai Kagaku Sha, December 10, Showa 53 issue).
[0003]
[Problem(s) to be Solved by the Invention] However, if it was in the image degradation amendment method of the image reader in the former, since fixed amendment processing was performed to the picture signal taken out with image sensors, when not breaking if suitable processing is performed to each image information, but obtaining quality image information, it was still inadequate. That is, since the image formation optical system of the image reader in the former had the image formation engine performance (MTF) which changes with locations of the field angle direction (equivalent to the scanning direction in image sensors) of an image formation lens as usually shown in drawing 12 , even if it performed fixed amendment processing to the picture signal, the image formation engine-performance error in the location of the field angle direction of an image formation lens was not able to remain as it is, and it was not able to obtain image information of high quality.
[0004] If it is in a color picture reader especially, the image formation engine performance (MTF) of the field angle direction of an image formation lens Since it differs for every [ by which the spectrum was carried out ] color component (red component [R], green component [G], and blue component [B]) as shown in drawing 1313 , Even if it performed fixed amendment processing to the picture signal, the technical technical problem that image information of the part in which not only the image formation engine-performance error in the location of the field angle direction of an image formation lens but the image formation engine-performance error for every color component remains as it is, and high quality cannot be obtained was more serious.
[0005] This invention is made in order to solve the above technical technical problem, it can amend appropriately image degradation based on image formation optical system, and offers the image reader

which made it possible to obtain the image information of high quality.

[0006]

[Means for Solving the Problem] Namely, this invention carries out the sequential exposure of the 2nd page of the manuscript on a platen 1 by the light source 3 for lighting at the shape of a slit, as shown in drawing 1 . Image formation of the slit-like reflected light from the 2nd page of a manuscript is carried out on the Rhine-like image sensors 5 by the image formation optical system 4. A location detection means 6 to detect the scanning direction s location in the image sensors 5 of the picture signal read with the above-mentioned image sensors 5 on the assumption that the image reader which read manuscript 2 image, It is characterized by to have an image formation engine-performance setting means 8 to set up the image formation engine-performance information on the image formation optical system 4 of the picture signal location detected with this location detection means 6, and a degradation amendment means 9 to amend the degradation condition of a picture signal according to the image formation engine-performance information set up with this image formation engine-performance setting means 8.

[0007] Moreover, invention in the case of applying to a color picture reader As shown in drawing 1 , the sequential exposure of the 2nd page of the manuscript on a platen 1 is carried out by the light source 3 for lighting at the shape of a slit. Image formation of the slit-like reflected light from the 2nd page of a manuscript is carried out on the Rhine-like image sensors 5 by the image formation optical system 4. A location detection means 6 to detect the scanning direction s location in the image sensors 5 of the picture signal read with the above-mentioned image sensors 5 on the assumption that the image reader which read manuscript 2 image, A color component detection means 7 to detect each color component of the picture signal read with the above-mentioned image sensors 5, An image formation engine-performance setting means 8 to set up the image formation engine-performance information on the image formation optical system 4 over the color component detected with the picture signal location and the color component detection means 7 which were detected with the above-mentioned location detection means 6, It is characterized by having a degradation amendment means 9 to amend the degradation condition of the picture signal of each color component according to the image formation engine-performance information set up with this image formation engine-performance setting means 8.

[0008] In such technical means, if it is detectable as the above-mentioned location detection means 6 of which location of the scanning direction of image sensors 5 it is a picture signal, the design change of carrying out counting of the read-out clock of image sensors 5 etc. can be carried out suitably.

[0009] Moreover, as a color component detection means 7, it is for taking out the picture signal for every color component, and if it is detectable of which color component the picture signal from image sensors 5 is a thing, it can select suitably. For example, what is necessary is just to make it detect by whether it is a signal from the image sensors 5 of which color component, if it is in the type possessing the image sensors 5 for every color component that what is necessary is just to see whether it is the signal which it is made to detect based on the carving timing of color separation, or is acquired from which output port of a color separation means if it is in the type which carries out color separation of the picture signal from one image sensors 5.

[0010] Furthermore, although it will select suitably and will not interfere as an image formation engine-performance setting means 8, if the image formation engine performance of the image formation optical system 4 can be set up, if the image formation engine performance is carried out from a viewpoint of setting up correctly For example, if it carries out from a viewpoint that it is desirable to read the pattern for image formation performance evaluations, and to compute image formation engine-performance information based on the reading information, and it simplifies an equipment configuration The image formation engine-performance information beforehand measured in well-known system of measurement is stored in memory, and it is desirable to read image formation engine-performance information from the inside of memory.

[0011] Furthermore, if the degradation condition of the picture signal based on the image formation engine performance of the image formation optical system 4 can be amended as a degradation amendment means 9, each multiplier of a digital filter is selected based on the image formation engine performance to a predetermined pixel location, and the design change of amending a picture signal through this digital filter etc. will be carried out suitably, and it will not interfere again. Moreover, if image quality is carried out from a viewpoint of raising more, it is desirable to make it change amendment processing extent to a picture signal gradually, for example according to selection modes, such as edge enhancement mode and graphics mode.

[0012]

[Function] A location detection means 6 detects the scanning direction s location in the image sensors 5 of the picture signal read with image sensors 5, an image-formation engine-performance setting means 8 sets up the image-formation engine-performance information on the image-formation optical system 4 of the picture signal location detected with the above-mentioned location detection means 6, and, according to the technical means which mentioned above, a degradation amendment means 9 amends the degradation condition of a picture signal according to the image-formation engine-performance information set up with said image-formation engine-performance setting means 8. If it is in a color picture reader especially, the color component detection means 7 detects each color component of the picture signal read with the above-mentioned image sensors 5. The image formation engine-performance setting means 8 Setting up the image-formation engine-performance information on the image-formation optical system 4 over the color component detected with the picture signal location and the color component detection means 7 which were detected with said location detection means 6, the degradation amendment means 9 amends the degradation condition of a picture signal according to the image-formation engine-performance information for every color component set up with said image formation engine-performance setting means 8. Moreover, if the switch selection means 10 is established, according to the selection mode chosen as arbitration, the amendment processing degree of the degradation amendment means 9 can be changed.

[0013]

[Example] Hereafter, this invention is explained to a detail based on the example shown in an accompanying drawing.

O Example 1 drawing 2 and drawing 3 show one example of the image reader with which this invention was applied. In this drawing, a sign 20 shows the whole image reader, an original cover 21 is fixed on a platen 23, and sequential lighting of the manuscript 22 laid on the platen 23 which consists of a clear glass plate is carried out by the halogen lamp 25 as the light source for lighting at the shape of a slit. In addition, a sign 26 is a reflector which converges the light from a halogen lamp 25 on the condensing section of a manuscript 22 from both sides. Image formation of the reflected light of a manuscript 22 is carried out on the Rhine-like image sensors 40 through the image formation optical system which consists of the mirrors 27, 29, and 30 for optical-path regulation, an image formation lens 31, and an infrared cut filter 32. Especially, in this example, the full rate carriage 24 carries the above-mentioned halogen lamp 25, a reflector 26, and a mirror 27, the half rate carriage 28 carries mirrors 29 and 30, the full rate carriage 24 and the half rate carriage 28 carry out the migration scan of the manuscript 22 toward the direction of arrow-head A in drawing 3 with the velocity ratio of 2:1, and image sensors 40 read the image information of the manuscript 22 whole region.

[0014] In this example image sensors 40 It is the thing of the three-line configuration corresponding to each color component. Each As shown in drawing 4 , the CCD (Charge Cuppled Device) component 41 is arranged in every predetermined pitch p (this example about p= 8 micrometers). It enables it to incorporate the picture signal of each color component for the corresponding CCD component 41 by arranging the filter for (Red R) components, a green (G) component filter, or (Blue B) component filter before each CCD component 41, respectively.

[0015] Moreover, in this example, the pattern 50 for image formation performance evaluations is attached in the field in which a manuscript 22 is not installed on the above-mentioned platen 23 along the field angle direction (equivalent to the scanning direction [the direction of arrow-head B in drawing 3 ] of image sensors 40) of image formation optical system. Especially the pattern 50 for image formation performance evaluations used in this example consists of perpendicular ladder patterns 52 of 4lp(line pair)/mm to the parallel ladder pattern 51 of 4lp(line pair)/mm, and said field angle direction to the field angle direction of said image formation optical system, as shown in drawing 5 .

[0016] Furthermore, the signal-processing system 60 of the above-mentioned image sensors 40 is shown in drawing 6 . In this drawing the signal-processing system 60 of image sensors 40 It has the amendment circuit 62 (concrete -- 62a [the object for red components], 62b [the object for green components], and 62c [the object for blue components]) which amends the degradation condition of the picture signal from each image sensors 40 (concrete -- 40a [the object for red components], 40b [the object for green components], and 40c [the object for blue components]). After reading the pattern 50 for image formation performance evaluations and grasping beforehand the image formation engine-performance information on image formation optical system before reading the image information of a manuscript 22, the image information of a manuscript 22 is read and the image information of a manuscript 22 is amended based on said image formation engine-performance information. In addition, although the output of each image sensors 40 is three-channel juxtaposition, it outputs odd pixels separately and you may make it process them even pixels in this example by with a colors [ each / every ] of two a total of six channels.

[0017] The example of the amendment circuit 62 in which it is used in this example is shown in drawing 7 . In this drawing, before reading the image information of a manuscript 22, in down stream processing which reads the pattern 50 for image formation performance evaluations, the picture signal for every color component from image sensors 40 is amplified by amplifier 71, then, removes a reset noise by the sample hold circuit 72, and is changed into digital data through A/D converter 73. And the digital data to the read pattern 50 for image formation performance evaluations is processed in the image formation engine-performance calculation section 74. In this image formation engine-performance calculation section 74, the modulation corresponding to each color component of the ladder pattern of the pattern 50 for image formation performance evaluations is computed, for example as image formation engine-performance information (for example, refer to JP,2-146571,A), and image formation engine-performance information is memorized by storage 75 for every location of the field angle direction of image formation optical system.

[0018] Next, in down stream processing which reads the image information of a manuscript 22, after the picture signal for every color component read with image sensors 40 is amplified by amplifier 71, next removes a reset noise by the sample hold circuit 72 and is changed into digital data through A/D converter 73, it is inputted into the degradation amendment circuit 76. Although the image processing by the digital filter of mxn is performed in this degradation amendment circuit 76, the multiplier used for the operation of this digital filter is sent out from the multiplier generating circuit 77. Moreover, as shown in drawing 8 , a sign 78 is a location calculation circuit where a picture signal computes whether it is a signal from the location of image-sensors 40 throat, and the image formation engine-performance information k in that location is read from storage 75 based on the positional information P of the picture signal acquired from this location calculation circuit 78. At this time, the above-mentioned multiplier generating circuit 77 consists of look-up tables by which the multiplier data ai (i= 0 -- k--n) of the digital filter for image degradation amendment were beforehand stored in the address corresponding to the image formation engine-performance information i (i= 0 -- k--n). If the above-mentioned image formation engine-performance information k is inputted as address signal Adr.k, the multiplier data ak corresponding to this will be sent out, and the digital filter multiplier of the above-mentioned degradation amendment circuit 76 will be set up. For this reason, the picture signal in each location of image sensors 40 is outputted by passing along the degradation amendment circuit 76 in the form which amended the degradation condition based on the image formation engine-performance information on each location in every color component.

[0019] O Example 2 drawing 9 shows the amendment circuit 62 used in the example 2. In this drawing, although the fundamental configuration of the amendment circuit 62 is the same as that of an example 1 and abbreviation, unlike the example 1, the address change-over circuit 80 is formed between storage 75 and the multiplier generating circuit 77.

[0020] This address change-over circuit 80 is a mode selection signal (in this example), as shown in drawing 10 R> 0. The mode selector 81 which carves the address signal from storage 75 according to edge enhancement mode, a canonical mode, and graphics mode, The edge enhancement mode change circuit 82 which changes an address signal into the address signal for edge enhancement modes at the time of edge enhancement mode selection, It has the graphics mode modification circuit 83 which changes an address signal into the address signal for graphics mode at the time of graphics mode selection, and an input address signal is outputted as it is at the time of canonical-mode selection. Moreover, in this example, each multiplier data of the above-mentioned multiplier generating circuit 77 is beforehand assigned to the edge enhancement mode field and graphics mode field other than a canonical-mode field. And fixed shift relation is set up between the address to a canonical-mode field, and the address of an edge enhancement mode field or a graphics mode field. By performing addition or subtraction of an address signal in the above-mentioned edge enhancement mode change circuit 82 or the graphics mode modification circuit 83 The multiplier data corresponding to the address signal which was changed into the address signal corresponding to each mode, and was changed from the multiplier generating circuit 77 are outputted to the degradation amendment circuit 76. To the object [ image / manuscript ] centering on an alphabetic character image, the degradation condition of a picture signal is amended in edge enhancement mode. Or to the object [ image / manuscript ] centering on a graphic image, the degradation condition of a picture signal is amended in graphics mode (mode in which it obscures on the whole).

[0021] O Example 3 drawing 11 shows the amendment circuit 62 concerning an example 3. Although exact image formation engine-performance information can be acquired for every equipment since the amendment circuit 62 concerning examples 1 and 2 computes image formation engine-performance information in the image formation engine-performance calculation section 74 when each reads the pattern 50 for image formation performance evaluations for every equipment, it is not avoided that an equipment configuration is complicated. On the other hand, since the amendment circuit 62 concerning this example measures beforehand the image formation engine-performance information on image formation optical system by another system of measurement and this measurement data was stored in storage 75, the pattern 50 for image formation performance evaluations and the image formation engine-performance calculation section 74 become unnecessary, moreover, down stream processing for acquiring image formation engine-performance information also becomes unnecessary, and that part and an equipment configuration are simplified.

[0022]

[Effect of the Invention] Since the degradation condition of a picture signal was amended in consideration of the image formation engine-performance information in each location of the field angle direction of image formation optical system according to invention according to claim 1 as explained above, image degradation based on image formation optical system can be amended appropriately, and the image information of high quality can be obtained. Especially, since the degradation condition of a picture signal was amended for every color component in the color picture reader in consideration of the image formation engine-performance information in each location of the field angle direction of image formation optical system according to invention according to claim 2, image degradation based on image formation optical system can be appropriately amended for every color component, and the color picture information on high quality can be acquired.

[0023] Moreover, since according to invention according to claim 3 the pattern for image formation performance evaluations is read and image formation engine-performance information was computed based on the reading information, the image formation engine performance of the image formation optical system for every equipment can be set up correctly, it can come together and the part and image degradation amendment can be realized correctly. Furthermore, since according to invention according to claim 4 the image formation engine-performance information beforehand measured in well-known system of measurement is stored in memory and image formation engine-performance information was read from the inside of memory, an equipment configuration can be simplified. Furthermore, according to invention according to claim 5, since it was made to change amendment processing extent to a picture signal gradually according to selection modes, such as edge enhancement mode and graphics mode, in the optimal condition for image reappearance, it can become possible to perform image degradation amendment, and the part and image quality can be raised more again.

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DRAWINGS

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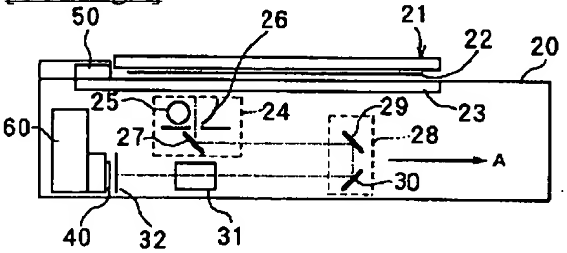
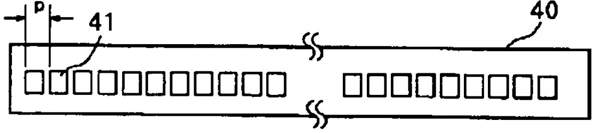
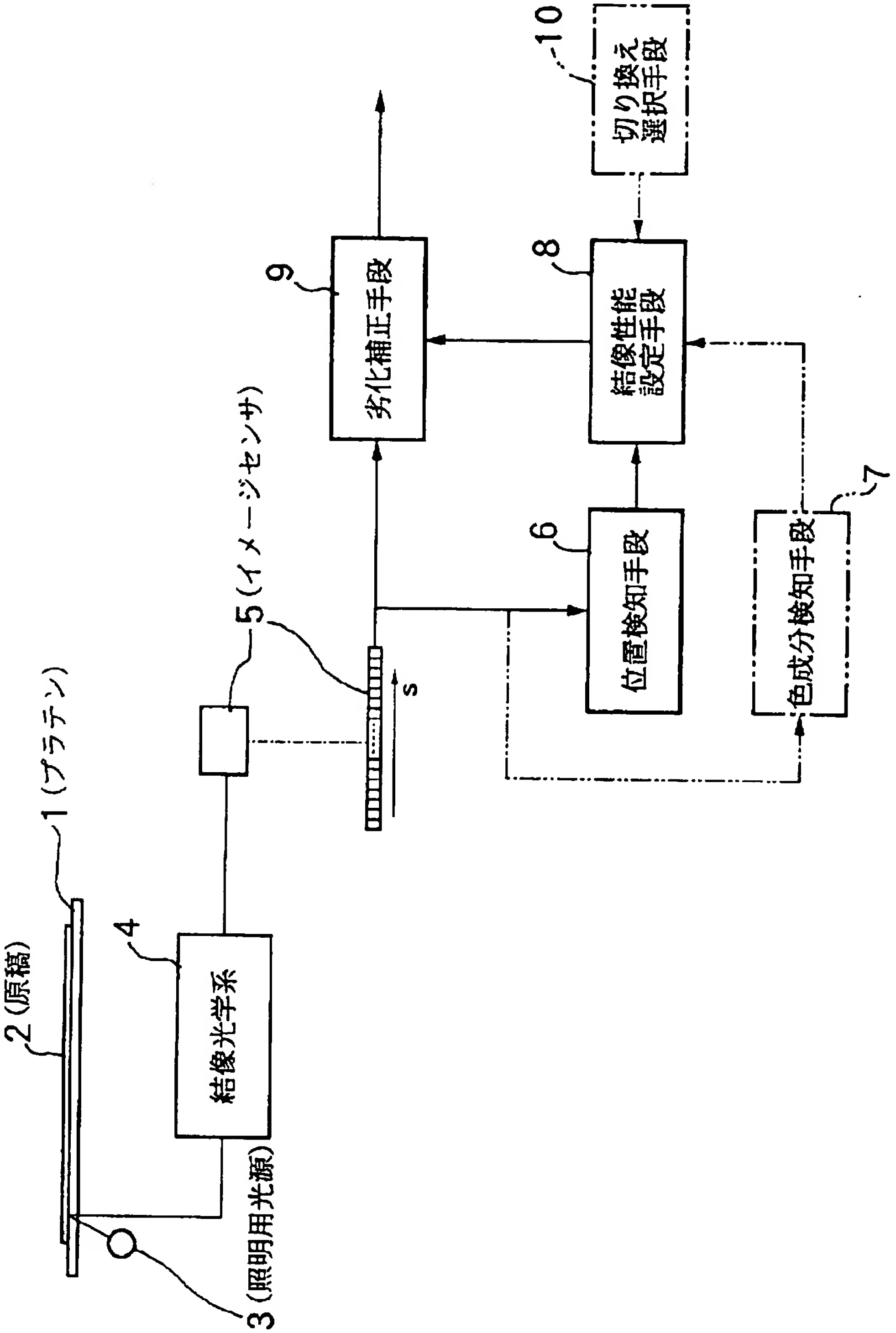
[Drawing 2]



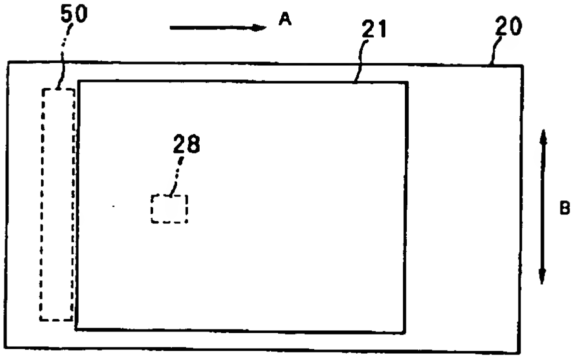
[Drawing 4]



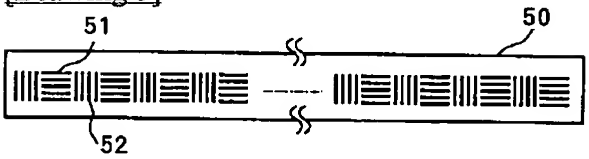
[Drawing 1]


1（プラテン）
2（原稿）
3（照明用光源）
4
結像光学系
5
5（イメージセンサ）
S
6
位置検知手段
7
色成分検知手段
8
結像性能設定手段
9
劣化補正手段
10
切り換え選択手段

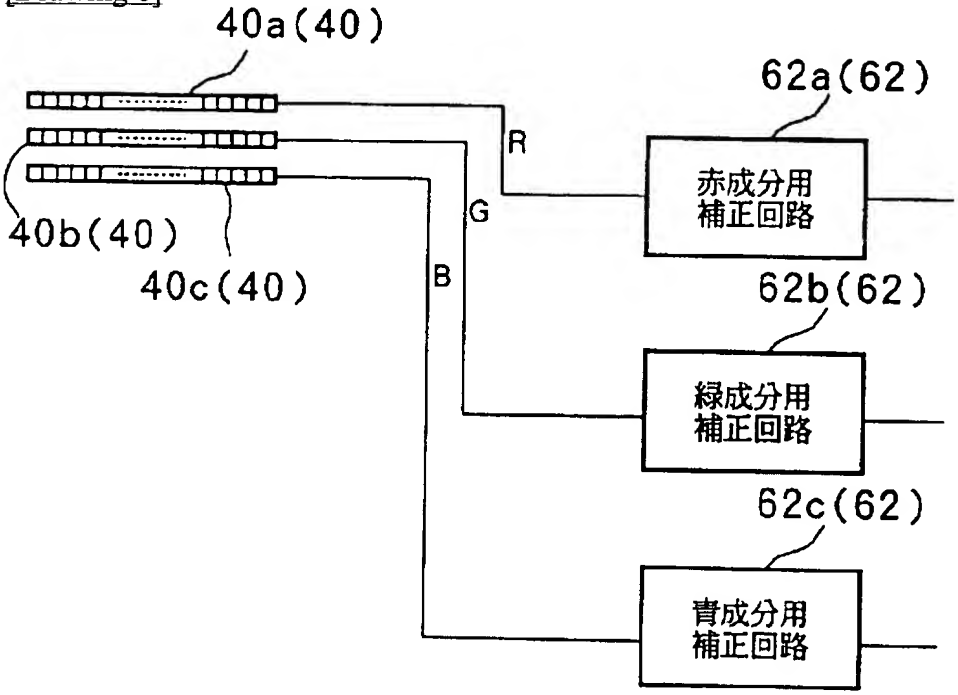
[Drawing 3]


50
A
21
20
28
B

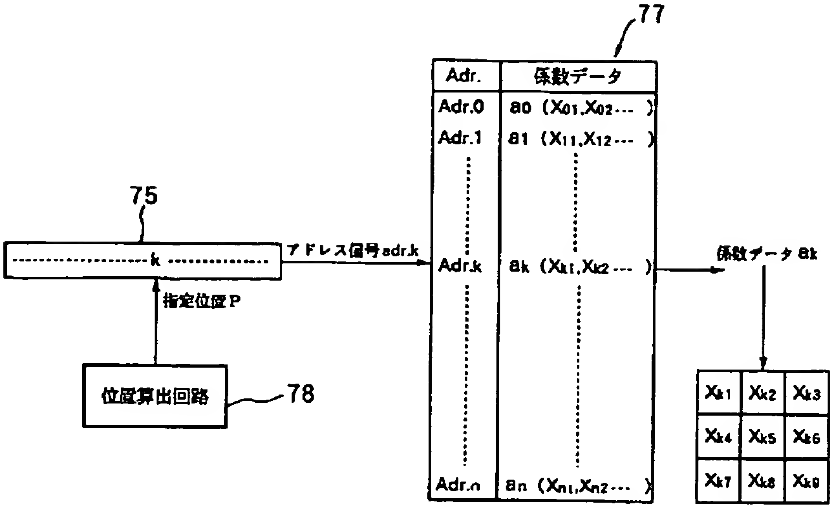
[Drawing 5]



[Drawing 6]


40a(40)
62a(62)
R
赤成分用
補正回路
40b(40)
G
40c(40)
B
62b(62)
緑成分用
補正回路
62c(62)
青成分用
補正回路

[Drawing 8]


77
Adr.
係数データ
Adr.0
Adr.1
Adr.k
Adr.n
a0 (X01,X02… )
a1 (X11,X12… )
ak (Xk1,Xk2… )
an (Xn1,Xn2… )
75
k
アドレス信号adr.k
指定位置P
位置算出回路
78
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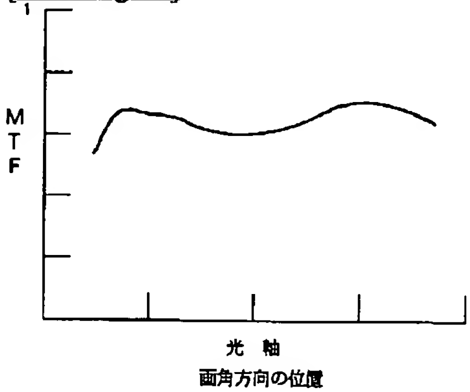
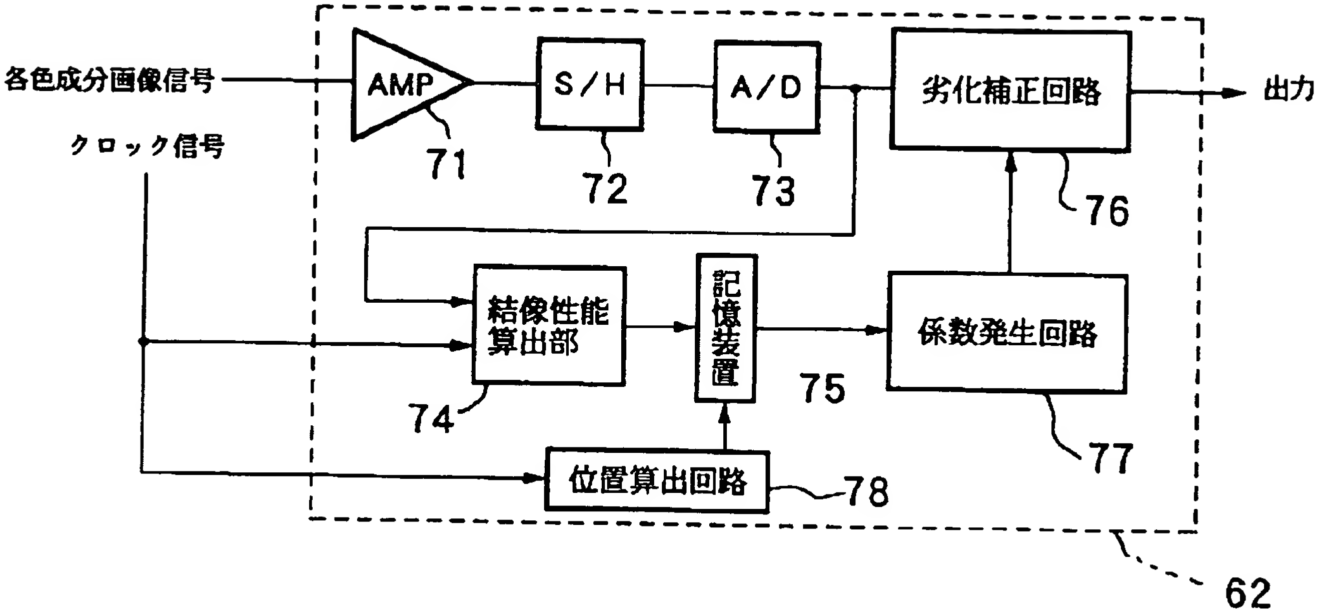
Xk8
Xk9

[Drawing 12]



[Drawing 7]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72
A/D
73
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76
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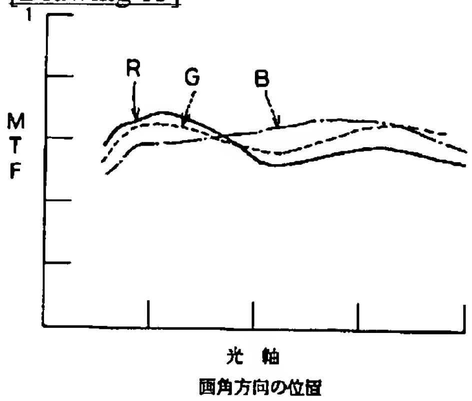
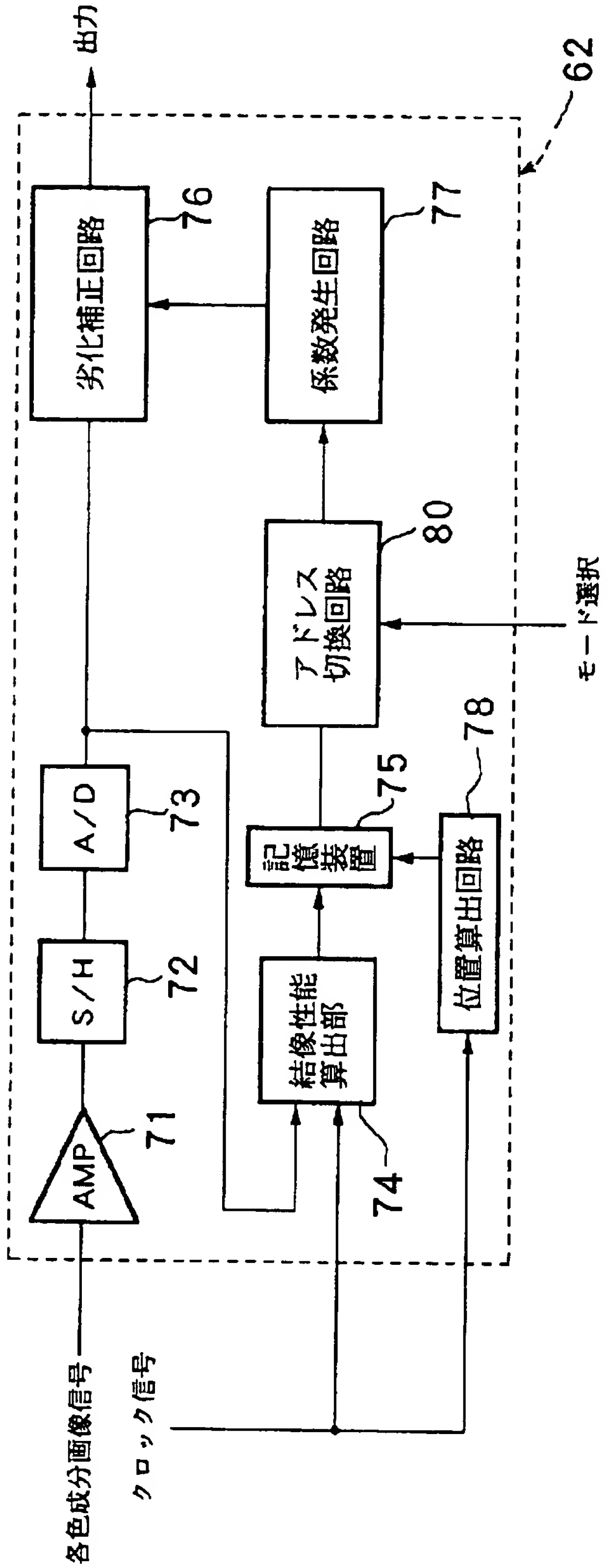
結像性能算出部
74
記憶装置
75
係数発生回路
77
位置算出回路
78
62

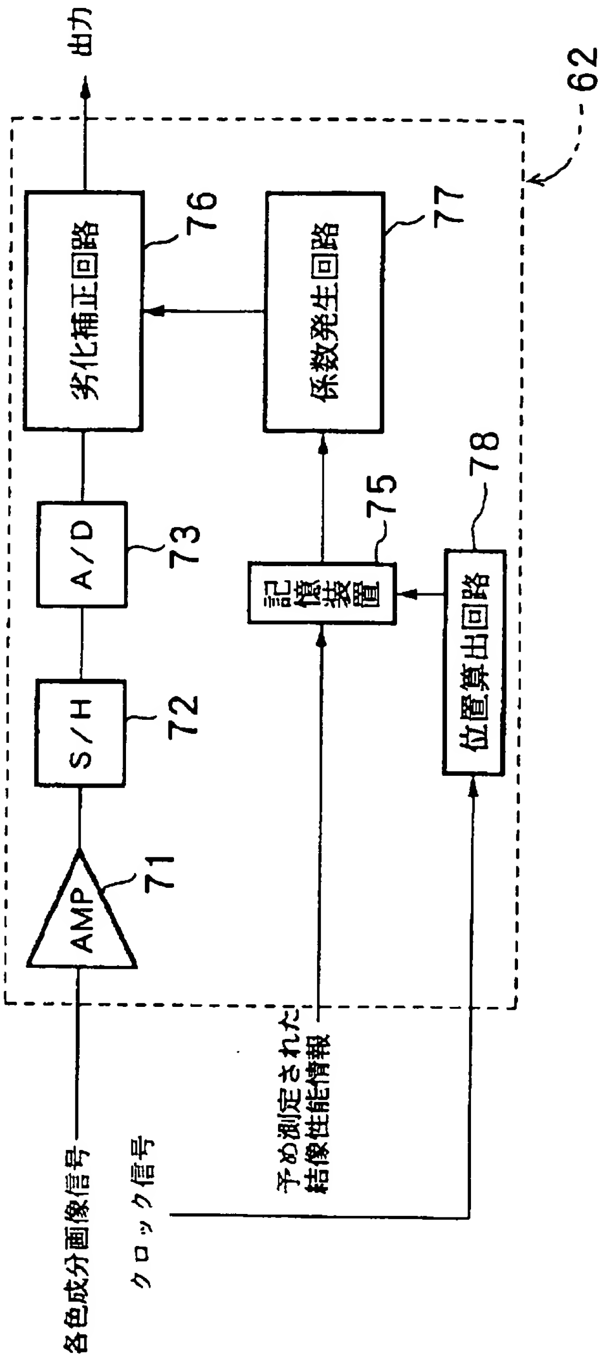
[Drawing 13]



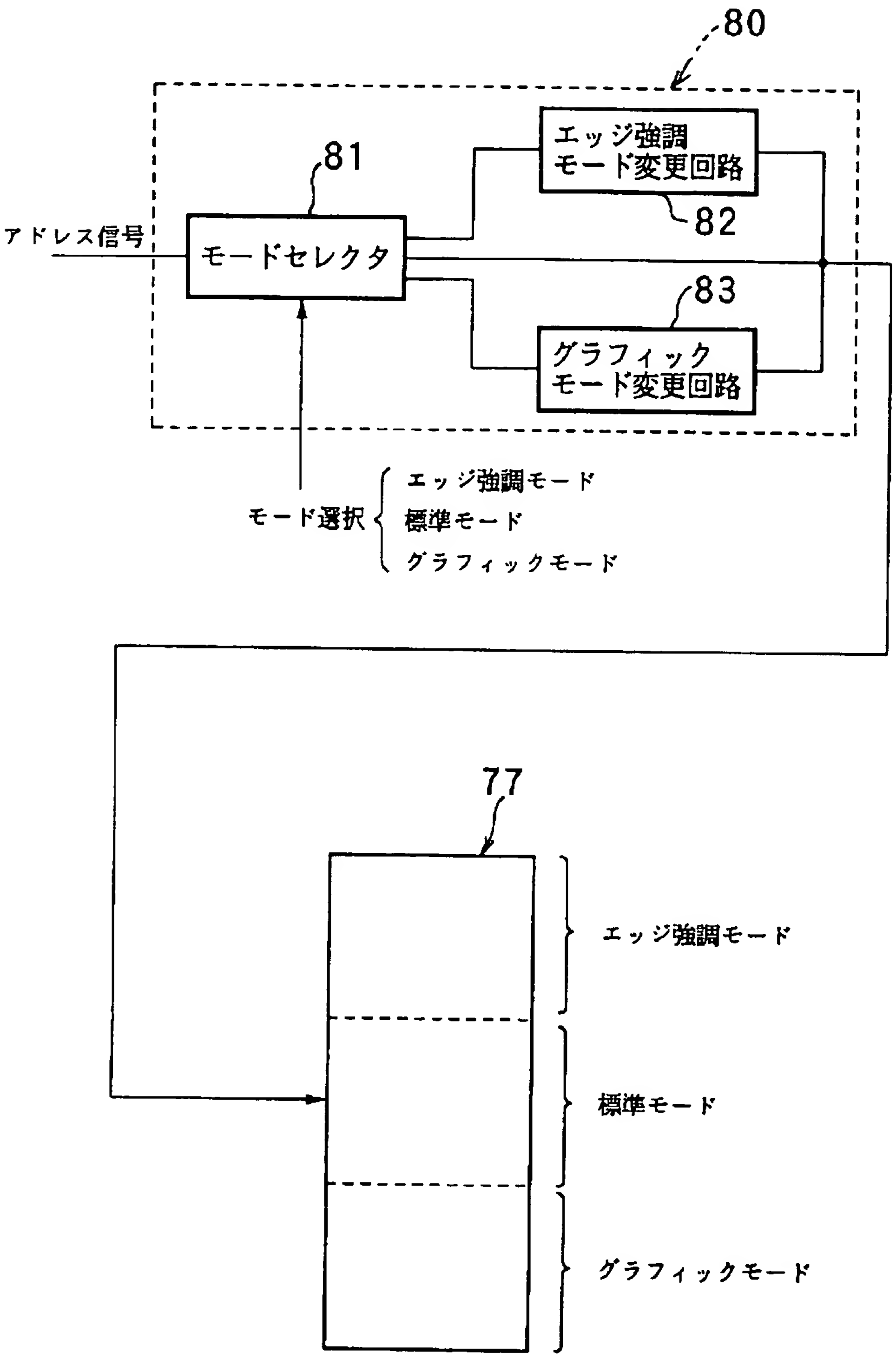
[Drawing 9]


出力
62
劣化補正回路
76
係数発生回路
77
アドレス切換回路
80
モード選択
記憶装置
75
位置算出回路
78
A/D
73
S/H
72
AMP
71
結像性能算出部
74
各色成分画像信号
クロック信号

[Drawing 11]


各色成分画像信号
クロック信号
予め測定された結像性能情報
AMP
71
S/H
72
A/D
73
記憶装置
75
位置算出回路
78
係数発生回路
77
劣化補正回路
76
62
出力

[Drawing 10]


80
81
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モード変更回路
モード選択
エッジ強調モード
標準モード
グラフィックモード
77
エッジ強調モード
標準モード
グラフィックモード

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[Translation done.]